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Southern Research Institute

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AIR MAIL

Commanding Officer
U. S. Army Chemical
Research and Development Laboratories
Edgewood Arsenal, Maryland

Attention: Mr. Abraham Koblin
Contract Project Officer

Reference: Monthly Progress Report
Contract No. DA18-108-AMC-32-A

Dear Sir:

The design study to develop techniques for measuring concentration and particle size distribution of chemical agents was continued during November. This progress letter summarizes the November work on: the effect of meteorology on sampling, the study of the aerosol flash-camera scheme, and the improvement of the sensitivity and response time of the electrochemical detector.

To aid in the literature survey we requested the loan of 15 reports from ASTIA. The primary purpose of these reports will be to provide us with more information on the chemical properties of the agents. However, some of the reports deal with detection and measurement, dissemination schemes, and field evaluation of the agents. When the information contained in these reports has been added to the notes made from our visit to CRDL the literature survey, Phase I, will be essentially complete. However, some attention will be given to the survey of the literature throughout the entire design study.

We have studied the role played by meteorology in the behavior of agents released in the atmosphere. Several current books and handbooks have been ordered to continue this study in Phase II of the project. The existence of widely divergent patterns of turbulence makes it important to consider the meteorological conditions of every test. It is obvious

that strong turbulence will give wide fluctuation to the dissemination data, and a great many data points will be required to obtain any meaningful information. A situation with negligible turbulence would be good for statistical data because the downwind concentration of agent would depend primarily on the average wind velocity. However, a situation with low turbulence usually occurs with a temperature inversion and the agent in the test would seek some level depending on its temperature and would tend to stay there. If this level were at ground level a good test would be possible, but if the level were aloft, ground sampling would be almost meaningless. In the case of an inversion below and lapsing aloft the agent cloud would not settle to the ground, except for the large particles. However, if there were an inversion aloft acting as a lid over the turbulence below, the conditions would be suitable for a good test. Some of these conditions were noticeable in the movies of actual dissemination trials shown at CRDL. If possible, all tests in a particular series should be made in the same type of weather conditions with respect to lapse rate and turbulence.

The preferred weather would be one with uniform, steady-state conditions, such as the conditions found with the lapse rate close to adiabatic lapse rate, or with an inverse lapse rate, which would favor surface dissemination. Unfortunately, these conditions are not very common and the inversions occur chiefly during the hours of darkness. Furthermore, the hours best suited for visual observation, convenience of personnel, and safety of operations—about 10:00 a. m. to 2:00 p. m.—coincide with the hours of greatest turbulence.

The theory of air turbulence is still developing and is incomplete. Present practice is to record actual wind variations in speed and direction. By recording the actual wind variation there is a direct measure of turbulence, but interpreting the measurement is difficult. Perhaps turbulence can be measured with a wind direction recorder having a very low inertia that will record the actual pattern of wind direction variation simultaneously with wind velocity variation.

We have not found much in the literature on the nature of a cloud itself. It is obvious that there is a small difference between the specific gravity and viscosity of a cloud and the gas in a cloud. Furthermore, it is evident that

the gas constant, the specific heat, the emissivity, space charge, and other properties will be slightly different in the cloud from those of the clear gas. A cloud is a transient thing that is different from second to second with particulate matter settling and agglomerating, temperature changing, and turbulent mixing all going on at once. It is very unlikely that a cloud could ever be precisely defined at any point in time. Our studies of meteorology and the study of the model cloud must be continued in conjunction with our study of the sampling techniques.

The aerosol flash-camera, which was described last month, is being studied, and we will begin to evaluate the basic components of the camera during December. It was brought to our attention last month that the Dage Division of Thompson Ramo Woolridge, Inc., had developed a spray-particle analyzer which resembled our plans for the aerosol flash-camera. A closer look at the Dage particle analyzer and a conversation with the project engineer revealed several basic differences in the camera that they had developed and the flash-camera that we plan for the CRDL work.

Experimental work on the electrochemical detection cell was started during November. An experiment is in progress to determine the effect of the conversion filter temperature on the speed of reaction. Experiments are also planned to try other types of conversion filters during December. The goal of both of these experiments will be to get a faster response and perhaps a larger electrical output from the electrochemical cell.

Commanding Officer
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During December emphasis will be placed on the design study of the aerosol flash-camera and some of the most important components will be tested. The work on the electrochemical cell will be continued by James Hostettler. The remainder of the project staff will be about the same; W. J. Barrett, Robert Collins, and Norman Francis.

Yours very truly

Alvin N. Bird, Jr.
Research Physicist
Instrument Development Section

Approved:

Sabert Oglesby, Jr., Head
Engineering Division

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